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Factors that influence the neurobiological effects of exercise likely extend beyond age and intensity in people with major depression

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Abstract

We recently conducted a comprehensive systematic review of neurobiological effects of exercise on major depressive disorder. A subsequent letter suggested that we should consider children and adolescent and raised the importance of how intensity may mediate neurobiological response in people with depression. Here, we discuss these comments regarding our review, in addition to proposing that other factors, such type, duration, frequency, and adherence, may also importantly influence neurobiological response, based on recent meta-analyses demonstrating these other aspects of physical activity also moderate dropout rates and effect sizes from exercise upon depression.

Key words: exercise, depression, neurobiological, adherence, intensity

Commentary

We would like to thank Dr. Budde and colleagues for their interest in our recent systematic review investigating neurobiological effects of exercise on major depressive disorder (Schuch et al., 2016a). We agree with Dr. Budde and colleagues commentary (Budde et al.) that exercise has a positive impact on depression throughout lifespan including adolescents (Carter et al., 2016), working age adults (Schuch et al., 2016b) and older adults (Schuch FB et al., 2016). However, Dr. Budde and colleagues made two comments on our recent systematic review which we would like to briefly respond and then further expand upon.

First, Dr. Budde and colleagues state that we did not consider studies in children and adolescents regarding the neurobiological effects of exercise and depression. We would like to highlight to Budde et al that, regardless age, our review focused on neurobiological responses to exercise in people with depression. Whilst we fully agree that understanding the neurobiological effect of exercise in adolescence is essential, we have not found any paper that meets our eligibility criteria. Dr. Budde and colleagues have shown evidence of differences in biological mechanisms involved in depression in children and adolescents (e.g: hyperactivation of HPA axis) when compared to adults with depression. In addition, studies in healthy children have shown different neurobiological responses to exercise. In spite of those differences, the neurobiological effects of exercise in children and adolescents with depression were not investigated. We clarify that future studies on the neurobiological effects of exercise for depression in children are still required.

Second, Dr. Budde and colleagues highlight the importance of the intensity of exercise as an influencing factor on biological responses to exercise. We agree with this point as we outline in our original paper; however, as with any systematic review, we are only able to report on the available data meeting our study eligibility. In spite of that, other original studies have recently reported findings on this point, such as Meyers et al., (2016) who demonstrated that higher exercise intensity promotes a greater acute increase on Brain Derived Neurotrophic Factors (BDNF) than lower intensity exercise in people with depression. Also, previous studies have discussed that exercise intensity moderates the responses of several hormones (Kraemer and Ratamess, 2005), neurogenesis (Szuhany et al., 2015), inflammatory markers (Cullen et al., 2016; Eyre and Baune, 2012), and oxidative stress markers (Powers et al., 2016), as well as cortical activity (Ludyga et al., 2016) in healthy (non-depressed) humans or animal models. A recent extensive meta-analysis examining the antidepressant effect of exercise have indicated that moderate and higher intensity exercise can result in a greater antidepressant effect

(Schuch et al., 2016b); nevertheless, increasing intensity is known to threaten adherence and influence dropout rates (Stubbs et al., 2016). Thus, the success of any exercise intervention and the subsequent neurobiological response is dependent upon adherence, which is moderated by exercise intensity. Moreover, a recent meta-analysis of randomized controlled trials has shown that numerous other factors mediate the antidepressant effect of exercise, such as being aerobic only and interventions supervised by an exercise professional (e.g. physiotherapist, exercise physiologists) (Schuch et al., 2016b). In addition, these very same factors may also influence dropouts from exercise among people with depression (Stubbs et al., 2016). Thus, whilst intensity is important, some balance has to be struck when considering longevity and sustainability of exercise among people with depression and other important aspects also need to be considered.

In summary, we are thankful that Budde and colleagues took the time to review our article on exercise and neurobiological effects among people with depression. We agree that further research should address this important topic in children. We also concur that intensity can influence the neurobiological effects of exercise; notwithstanding, other factors, such as exercise type, duration, frequency, and adherence, may be equally important in acquiring an adequate antidepressant response from exercise.

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